VETERINARY/ANIMAL PHYSIOLOGY

Chapter 3: Respiration

Respiration: -

- **External Respiration:** Exchange of gases between the external environment and the lungs.
- **Internal Respiration:** Exchange of gases between the blood and the body's tissues.
- **Cellular Respiration:** Cellular respiration is the metabolic process within cells that utilizes oxygen to produce energy in the form of adenosine triphosphate (ATP).

Respiratory Structures: -

i. **Conducting Zone**
   - It includes nose, pharynx, larynx, trachea, bronchi, and bronchioles.
   - Conducts air to respiratory zone.

ii. **Respiratory Zone**
   - It includes bronchioles, alveolar ducts, and alveoli.
   - Site of gas exchange.

Gas transport: -

i. **Transport of Oxygen**
   - 98.5% oxygen carried bound to haemoglobin
   - 1.5% dissolved in plasma

2. **Transport of Carbon Dioxide**
   - 70% as bicarbonate ions
   - 23% bound to haemoglobin
   - 7% dissolved in plasma

Note: -

- **Bohr Effect:** The oxygen-binding affinity of Hb decreases as the PCO_2 and H^+ concentration increases, enhancing oxygen release in metabolically active tissues.
- **Haldane Effect (C-D-H effect):** The oxygenation of Hb in the lungs promotes the release of CO_2 from Hb, influencing the blood's capacity to transport both oxygen and carbon dioxide.
- **Hering-Breuer Reflex:** The Hering-Breuer Reflex is a protective mechanism that prevents overinflation of the lungs, triggered by stretch receptors in the bronchi and bronchioles, leading to the inhibition of inspiration.
- **Chloride shift (Hamburger phenomenon):** Exchange of chloride ions for bicarbonate ions in red blood cells, facilitating the transport of carbon dioxide from tissues to the lungs in the bloodstream.

Laws: -

- **Boyle's Law:** At constant temperature, the pressure of a given amount of gas is inversely proportional to its volume.
- **Charles's Law:** At constant pressure, the volume of a gas is directly proportional to its absolute temperature.
- **Henry's Law:** The solubility of a gas in a liquid is directly proportional to the partial pressure of that gas above the liquid.
- **Laplace's Law:** The tension, radius, and pressure in a spherical structure, such as a bubble or alveolus, stating that the pressure is directly proportional to the tension and inversely proportional to the radius.
- **Fick's Law:** The rate is directly proportional to the surface area, the partial pressure difference, and the diffusion coefficient, and inversely proportional to the thickness of the membrane.

Terminologies: -

- **Eupnea:** Normal breathing
- **Apnea:** Cessation of breathing
- **Dyspnea:** Difficult breathing
- **Polypnea (Tachypnea/Panting):** Rapid, shallow breathing
- **Hyperpnea:** Increase depth, frequency or both
- **Hypoxia:** Inadequate oxygen supply to tissues and organs
- Hypercapnia: Elevated level of carbon dioxide (CO_2) in the bloodstream
- **Asphyxia:** Hypercapnia + hypoxia

The oxygen-haemoglobin dissociation curve: -

- The curve depicts the relationship between PO_2 and Hb saturation in blood
- Increase in CO_2, Acidity (H^+), 2,3-DPG, Exercise and Temperature cause the curve shift to right.
- **2,3-DPG:** Produced in RBC in response to low oxygen levels. Decreases Hb-oxygen affinity, enhancing oxygen release at tissues.
- **Shape:**
  - For adult Hb: Sigmoidal or S shaped
  - For foetal Hb: Steeper shaped

Regulation of respiration: -

1. Nervous control

S.N.	Respiratory centre	Location	Functions
1.	**Dorsal respiratory group**	Dorsal medulla	Responsible for inspiration and generate basic rhythm of breathing
2.	**Ventral respiratory group**	Ventral medulla	Responsible for expiration (mainly forced expiration)
3.	**Pneumotaxic centre**	Upper pons	Terminate inspiration, regulates inspiratory volume & respiratory rate
4.	**Apneustic centre**	Lower pons	Responsible for deep inspiration

2. Chemoreceptors

i. Central chemoreceptors

- located in the medulla
- Stimulated by increased PCO_2 via an associated change in H^+ ion of CSF fluid

ii. Peripheral chemoreceptors

- Located at bifurcation of carotid arteries and aortic arch
- Stimulated by decreased O_2, increased PCO_2 & increased H^+ ion in arterial blood
- Carotid body sends their signal to respiratory centre by Glossopharyngeal nerve
- Aortic arch sends their signal to respiratory centre by Vagus nerve

Lung Volumes and Capacities: -

Measure	Quantity	Functional Definition
Tidal Volume (TV)	500 ml	Volume of air inhaled or exhaled during normal breath
Inspiratory Reserve Volume (IRV)	2500 ml	Maximal volume of air that can be inhaled over and above the normal inspiration
Expiratory Reserve Volume (ERV)	1500 ml	Maximal volume of air that can be exhaled over and above the normal expiration
Residual Volume (RV)	1500 ml	Volume of air remaining in the lungs after a maximal exhalation
Total Lung Capacity (TLC)	6000 ml	Maximal volume of air in the lungs at the end of a maximal inspiration (RV + TV + ERV + RV)
Functional Residual Capacity (FRC)	3000 ml	Volume of air present in the lung at end of normal expiration (RV + ERV)
Inspiratory Capacity (IC)	3000 ml	Maximal volume of air that can be inhaled after normal expiration (IRV + TV)
Vital Capacity (VC)	4500 ml	Maximal volume of air that can be forcefully inspired after a forceful expiration (IC + TV + ERV)

The difference between mammalian and avian respiration: -

S.N.	Aspect	Mammalian respiration	Avian respiration

1.	**Respiratory system**	Lungs are primary organ for respiration	Air sac and lungs collectively contributes to respiration
	Efficiency of respiratory system	Less efficient	More efficient
2.	**Surfactant-secreting cells**	Type-II Pneumocytes	Granular/trilaminar cells
3.	**Gas exchange**	Alveoli	Parabronchi/tertiary bronchi
4.	**Voice-box**	larynx	syrinx
5.	**Diaphragm**	Primary muscle for breathing	absent
6.	**Inspiration & expiration**	Inspiration-active Expiration-passive	Both active

Note: -

- Dipalmitoylphosphatidycholine (DPPC), act as a pulmonary surfactant.
- Birds have nine air sacs (two cervical, two ant. thoracic, two post. Thoracic, two abdominal and unpaired clavicular air sac)
- There are two types of parabronchi in birds: Paleopulmonic (ancient) and Neopulmonic (new lung)
- Air flow in Paleopulmonic parabronchi is unidirectional, whereas in neopulmonic parabronchi it is bidirectional
- Paleopulmonic parabronchi founds in all birds
- In penguin and emu, neopulmonic parabronchi is absent
- In fowl and song birds, neopulmonic parabronchi is more developed than Paleopulmonic parabronchi

Respiratory Disorders: -

- **Asthma:** Chronic inflammation of airways, bronchoconstriction, and increased mucus production.
- **Emphysema:** Destruction of alveolar walls, dilation and rapture of alveoli is seen
- **Atelectasis:** the partial or complete collapse of a lung, failure of alveoli to open
- **Chronic Bronchitis:** Inflammation and irritation of bronchial tubes, leading to excessive mucus production.

Multiple Choice Questions

1. What is the organ of phonation in mammals
    a. Larynx
    b. Pharynx
    c. Syrinx
    d. Oesophagus
2. Which one of followings organ of phonation in birds
    a. Pharynx
    b. Syrinx
    c. Oesophagus
    d. Larynx
3. Which one is the smallest subdivision of the air passages
    a. Alveoli
    b. Trachea
    c. Oesophagus
    d. Glottis
4. In which of the following species, there are two phases during inspiration and, two phases are present during expiration
    a. Dog
    b. Cattle
    c. Swine
    d. Horse
5. ……. carries deoxygenated blood is called as
    a. Aorta
    b. Heart
    c. Pulmonary artery
    d. Pulmonary vein
6. Exchange of gases between lungs and pulmonary capillaries is known as
    a. Pulmonary ventilation
    b. Gas transport
    c. Internal respiration
    d. External respiration
7. Exchange of gases between blood and tissues is called as
    a. Pulmonary ventilation
    b. Internal respiration
    c. External respiration
    d. Cellular respiration
8. The inhalation and exhalation of air in and out of the lungs is
    a. Pulmonary ventilation
    b. Internal respiration
    c. External respiration

d. Gas transport

9. Actula gas exchange takes place in which of the followings
    a. Trachea
    b. Small bronchioles
    c. Alveoli
    d. Alveoli ducts
10. Instrument required for required for recording of pulmonary volumes and capacities
    a. Spirometer
    b. Anemometer
    c. Spirograph
    d. Sphygmomanometer
11. Spirometer cannot measure
    a. Vital Capacity
    b. Functional Residual Volume
    c. Expiratory Reserve Volume
    d. Inspiratory Reserve Volume
12. Vital capacity of lungs is
    a. ERV+RV
    b. IRV+TV
    c. IRV+TV+ERV
    d. ERV+TV
13. Volume of the gas that can still be inspired at the end of a normal tidal inspiration is known as
    a. Residual volume
    b. Tidal volume
    c. Expiratory Reserve Volume
    d. Inspiratory Reserve Volume
14. Volume of the gas that can still be expired at the end of a normal tidal expiration is known as
    a. Residual volume
    b. Tidal volume
    c. Expiratory Reserve Volume
    d. Inspiratory Reserve Volume
15. Which one of the following is true for a resting animal
    a. TLC>VC>TV>FFRC
    b. TLC>FRC>TV>VC
    c. TLC>VC>FRC>TV
    d. VC>TLC>TV>FRC
16. The volume of air remaining in the lungs after maximal expiration is called as
    a. Residual volume
    b. Tidal volume
    c. Expiratory Reserve Volume
    d. Inspiratory Reserve Volume
17. Inspiratory Capacity is defined as

a. The total amount of air that can be inspired after a tidal expiration
b. The total volume of exchangeable air
c. The total amount of air inspired after a tidal inspiration
d. Another name for Vital Capacity

18. ……. cycles are characterised by a deep, rapid inspiration followed by expiration of longer duration
    a. Complementary breathing
    b. Sigh
    c. Both a and b
    d. Coastal breathing
19. ……is a characterized by pronounced rib movement. When breathing becomes difficult, this kind of breathing becomes more pronounced
    a. Complementary breathing
    b. Sigh
    c. Both a and b
    d. Coastal breathing
20. Complementary breathing cycles (Sigh) apparently not present in which species
    a. Cattle
    b. Goat
    c. Pig
    d. Horse
21. Collateral ventilation is a feature of
    a. Cattle
    b. Goat
    c. Pig
    d. Dog
22. Purring is seen in which species
    a. Cat
    b. Dog
    c. Cattle
    d. Horse
23. What is the primary function of the respiratory centre in the medulla oblongata?
    a. It stimulates the diaphragm to contract during expiration
    b. It inhibits the diaphragm during inspiration
    c. It controls the rate and depth of breathing
    d. It regulates blood pH by releasing carbon dioxide
24. Which statement accurately describes the function of the epiglottis?
    a. The epiglottis prevents food from entering the trachea during swallowing
    b. The epiglottis enhances air exchange in the alveoli
    c. The epiglottis produces mucus for respiratory lubrication
    d. The epiglottis regulates vocal cord tension
25. How does the respiratory system respond to an increase in carbon dioxide levels in the blood?
    a. By decreasing the respiratory rate

b. By increasing the respiratory rate
c. By constricting bronchioles
d. By decreasing the tidal volume

26. What role does the diaphragm play in the process of respiration?
    a. It assists in vocalization
    b. It regulates blood pH by excreting carbon dioxide
    c. It controls the volume of air inhaled and exhaled
    d. It produces surfactant for alveolar stability
27. Which statement accurately describes the role of the respiratory system in acid-base balance?
    a. The respiratory system primarily excretes excess acid through urine
    b. The respiratory system regulates blood pH by controlling carbon dioxide levels
    c. The respiratory system has no impact on acid-base balance
    d. The respiratory system directly neutralizes excess base in the blood
28. Normal, quiet respiration is called as
    a. Costal respiration
    b. Abdominal respiration
    c. Sigh
    d. None of the above
29. The effect of surface tension on pulmonary alveoli can be clarified by
    a. Boyle's low
    b. Charle's low
    c. Laplace's low
    d. Henry's low
30. The low which explains the effect of temperature on gas volume is known as
    a. Boyle's low
    b. Charle's low
    c. Laplace's low
    d. Henry's low
31. The low which explains the relationship between volume of gas and solubility is given by
    a. Boyle's low
    b. Charle's low
    c. Laplace's low
    d. Henry's low
32. Which one of the followings is the main site for gas exchange
    a. Type-I alveolar cells
    b. Type-II alveolar cells
    c. Septal cells
    d. None of the above
33. Surfactant is produced by which cells
    a. Type-I alveolar cells
    b. Type-II alveolar cells
    c. Septal cells
    d. None of the above

34. The functions for pulmonary surfactant
    a. Prevents alveolar collapse
    b. Decrease alveolar surface tension
    c. Increase lung compliance
    d. All of the above
35. In bird surfactant produced by
    a. Trilaminar cells
    b. Type-I alveolar cells
    c. Type-II alveolar cells
    d. Septal cells
36. Which of the following is known as normal and quiet breathing
    a. Eupnea
    b. Polypnea
    c. Dyspnea
    d. Hyperpnea
37. Difficulty in breathing is known as
    a. Eupnea
    b. Polypnea
    c. Dyspnea
    d. Hyperpnea
38. Increase in the depth, frequency or both after severe exercise is termed as
    a. Eupnea
    b. Polypnea
    c. Dyspnea
    d. Hyperpnea
39. Rapid, shallow breathing, similar to breathing is termed as
    a. Eupnea
    b. Polypnea (Tachypnea)
    c. Dyspnea
    d. Hyperpnea
40. Asphyxia is described as
    a. Hypoxia + hypocapnia
    b. Hypercapnia + hypoxia
    c. Cyanosis + Hypocapnia
    d. Hypoxia + bradypnea
41. …….is a measurement of the distensibility of the lungs
    a. Lung compliance
    b. Emphysema
    c. Pneumothorax
    d. Pneumonia
42. Listening of the lung sound with the help of stethoscope is known as
    a. Percussion
    b. Auscultation
    c. Both a & b

d. None of the above

43. The condition in which air enters the space between the visceral and partial pleura is called as
    a. Lung compliance
    b. Emphysema
    c. Pneumothorax
    d. Pneumonia
44. Acute hyperventilation causes
    a. Respiratory alkalosis
    b. Respiratory acidosis
    c. Respiratory distress
    d. All of the above
45. Acute hyperventilation causes
    a. Respiratory alkalosis
    b. Respiratory acidosis
    c. Respiratory distress
    d. All of the above
46. The volume of gas that is inspired but which do not take part in gas exchange in the airways and alveoli is known as
    a. Anatomical dead space
    b. Physiological dead space
    c. Respiratory dead space
    d. Alveolar dead space
47. The upper portion of airway where no diffusion of gases between blood and the airways down to the bronchioles is termed as
    a. Anatomical dead space
    b. Physiological dead space
    c. Respiratory dead space
    d. Alveolar dead space
48. An air pressure in the lungs and the passages leading to them is called as
    a. Intrapulmonic pressure
    b. Intrapleural pressure
    c. Intra-alveolar presuure
    d. Both a & c
49. The pressure in the thorax outside the lungs called as
    a. Intrapulmonic pressure
    b. Intrapleural pressure
    c. Intrathoracic pressure
    d. Both b & c
50. During inspiration……. becomes slightly sub atmospheric
    a. Intrapulmonic pressure
    b. Intrapleural pressure
    c. Intrathoracic pressure
    d. Both a & c

51. Oxygen transport takes place in the blood in the form of
    a. As physically dissolved form
    b. In oxyhaemoglobin form
    c. Both a & b
    d. None of the above
52. The partial pressure of O_2 and CO_2 (mmHg) at alveolar level is
    a. 104, 40
    b. 40, 104
    c. 45, 40
    d. 100, 50
53. The partial pressure of O_2 and CO_2 (mmHg) at arterial level is
    a. 45, 40
    b. 95, 40
    c. 100, 20
    d. 40, 45
54. How does the respiratory system respond to low oxygen levels in the blood?
    a. By decreasing the respiratory rate
    b. By constricting blood vessels in the lungs
    c. By releasing erythropoietin to stimulate red blood cell production
    d. By promoting the breakdown of haemoglobin
55. Which statement accurately describes the function of the nasal conchae in the nasal cavity?
    a. The nasal conchae produce mucus for filtration
    b. The nasal conchae warm and humidify inhaled air
    c. The nasal conchae contain taste receptors
    d. The nasal conchae regulate vocal cord tension
56. During exercise, what happens to respiratory rate and tidal volume?
    a. Both respiratory rate and tidal volume decrease
    b. Both respiratory rate and tidal volume increase
    c. Respiratory rate increases, but tidal volume decreases
    d. Respiratory rate decreases, but tidal volume increases
57. Which statement is true regarding the composition of inspired air?
    a. Inspired air is always saturated with water vapor
    b. Inspired air has a constant concentration of oxygen
    c. Inspired air contains a higher percentage of carbon dioxide than expired air
    d. Inspired air contains a higher percentage of nitrogen than oxygen
58. What is the primary factor that influences the diffusion of gases across the respiratory membrane in the alveoli?
    a. Thickness of the respiratory membrane
    b. Concentration of nitrogen in the alveoli
    c. Size of the alveoli
    d. Presence of surfactant
59. Respiratory quotient is
    a. Volume of CO_2 produced/Volume of O_2 consumed
    b. Volume of CO_2 consumed /Volume of O_2 consumed

c. Volume of CO_2 consumed /Volume of O_2 produced
d. Volume of CO_2 produced /Volume of O_2 produced

60. Which of the following group is arranged in correct order for respiratory quotient (RQ)value
    a. Carbohydrate > fat > protein
    b. Fat > protein > carbohydrate
    c. Protein > fat > carbohydrate
    d. Carbohydrate > protein > fat
61. Amount of O_2 carried by 100 ml of blood is
    a. 30 ml
    b. 40ml
    c. 20ml
    d. 10ml
62. The binding of O_2 to Hb is characterized as
    a. Compliant
    b. Irreversible
    c. Reversible
    d. noncompliant
63. The loading and unloading of O_2 ability of Hb in the form of graph known as
    a. Oxyhaemoglobin dissociation curve
    b. Carboxyhaemoglobin dissociation curve
    c. Myoglobin dissociation curve
    d. Methaemoglobin dissociation curve
64. For adult O_2 transport oxyhaemoglobin dissociation curve is
    a. Sigmoid
    b. S shape
    c. Both a & b
    d. None of the above
65. For foetal O_2 transport oxyhaemoglobin dissociation curve is
    a. Sigmoid
    b. S shape
    c. Steeper
    d. All of the above
66. As blood moves to the lungs from the tissues, the Oxyhaemoglobin dissociation curve shifts to;
    a. Right
    b. Left
    c. Up
    d. Down
67. Foetal haemoglobin has greater affinity for O_2 than adult haemoglobin because;
    a. Its concentration is very high
    b. Foetal blood gets O_2 from mother
    c. It binds 2,3 DPG less avidly by gamma polypeptide chain than HbA
    d. Its polypeptide chain binds very fast with oxygen

68. 2,3 DPG present in
    a. Blood plasma
    b. RBC
    c. WBC
    d. Blood of lungs
69. The majority of carbon dioxide is transported in the blood
    a. Attached to Hb
    b. Dissolved in the plasma
    c. As bicarbonate ion in RBC
    d. As carbon monoxide in RBC
70. CO_2 combines with Hb to form
    a. Carbaminohaemoglobin
    b. Carboxyhaemoglobin
    c. Myoglobin
    d. Methaemoglobin
71. During transportation of carbon dioxide when bicarbonate ion diffuses from RBC into the plasma, the increase hydrogen ion concentration in RBC is balanced by the entry of which substance from plasma
    a. Humberger shift
    b. Chloride shift
    c. Both a & b
    d. Haldane effect
72. Effect of O_2 on hydrogen ion and CO_2 loading and unloading from haemoglobin is termed as
    a. C-D-H effect
    b. Haldane effect
    c. Both a & b
    d. Bohr effect
73. Bohr effect explains
    a. Hb binds CO more readily than O_2
    b. Hb unloads its O_2 when it encounters low pH
    c. Diffusion occurs so slowly over long distance
    d. O_2 is present in the atmosphere in relatively low concentrations
74. Double Bohr effect occurs in;
    a. Foetal circulation
    b. Maternal circulation
    c. In the placenta operating in both maternal and foetal circulation
    d. In the uterine wall
75. In chloride shift, chloride ion diffuses
    a. Into RBC to maintain electrical neutrality
    b. Out of RBC to maintain electrical neutrality
    c. Into RBC to maintain pH
    d. Out of RBC to maintain pH
76. Hering-Breuer reflex serves as a protective mechanism to prevent

a. Tracheal collapse
b. Excess oxygenation
c. Excess lung inflation
d. All of the above

77. Which statement accurately describes the role of haemoglobin in the respiratory system?
a. Haemoglobin binds to oxygen and releases carbon dioxide
b. Haemoglobin binds to carbon dioxide and releases oxygen
c. Haemoglobin only transports nitrogen in the blood
d. Haemoglobin has no role in gas exchange

78. Regarding pulmonary ventilation, which statement is correct?
a. During inspiration, intrapulmonary pressure decreases
b. During expiration, intrapulmonary pressure increases
c. During both inspiration and expiration, intrapulmonary pressure remains constant
d. Intrapulmonary pressure is not affected by respiratory movement

79. What effect does sympathetic stimulation have on bronchioles?
a. Bronchioles constrict
b. Bronchioles dilate
c. Sympathetic stimulation has no impact on bronchioles
d. Bronchioles become rigid

80. How does the Bohr effect influence oxygen transport?
a. It enhances oxygen binding to haemoglobin in low pH conditions
b. It reduces oxygen binding to haemoglobin in low pH conditions
c. It has no impact on oxygen transport
d. It only affects carbon dioxide transport

81. Which statement is true regarding the Haldane effect?
a. It describes the effect of oxygen concentration on carbon dioxide binding to haemoglobin
b. It explains the increased affinity of haemoglobin for carbon dioxide in low oxygen conditions
c. It has no relation to respiratory physiology
d. It only affects oxygen dissociation from haemoglobin

82. The urge to inhale because of
a. Rising PO_2
b. Falling PO_2
c. Rising PCO_2
d. Falling PCO_2

83. Mechanism for regulation of respiration
a. Nervous
b. Chemical
c. Humoral
d. All of the above

84. The respiratory control centre is located in the
a. Medulla oblongata
b. Alveoli

c. RBC
d. Trachea

85. Group of neurons located in the dorsal part of medulla
    a. Dorsal Respiratory Group
    b. Ventral Respiratory Group
    c. Pneumotaxic & Apneustic centre
    d. All of the above
86. Group of neurons located in the ventrolateral part of medulla
    a. Dorsal Respiratory Group
    b. Ventral Respiratory Group
    c. Pneumotaxic & Apneustic centre
    d. All of the above
87. Neuron of the Dorsal Respiratory Group primarily
    a. Generate the basic rhythm of breathing
    b. Responsible for expiration
    c. Limit inspiration
    d. Responsible for deep inspiration
88. Group of the neurons work for inspiration centre
    a. Dorsal Respiratory Group
    b. Ventral Respiratory Group
    c. Pneumotaxic & Apneustic centre
    d. All of the above
89. Group of the neurons associated with both inspiration and expiratory activity
    a. Dorsal Respiratory Group
    b. Ventral Respiratory Group
    c. Pneumotaxic & Apneustic centre
    d. All of the above
90. Neuron of the Ventral Respiratory Group responsible for
    a. Generate the basic rhythm of breathing
    b. Primarily Responsible for expiration
    c. Limit inspiration
    d. Responsible for deep inspiration
91. Pneumotaxic centre located in
    a. Dorsal side of medulla
    b. Ventral side of medulla
    c. Pons
    d. Carotid artery
92. Pneumotaxic centre is responsible for
    a. Basic rhythm of breathing
    b. For expiration
    c. Deep inspiration
    d. Limit inspiration and therefor regulates inspiratory volume and respiration rate
93. Apneustic centre located in
    a. Ventral medulla

b. Dorsal medulla
c. Rostral pons
d. Caudal pons

94. Apneustic centre responsible for
a. Basic rhythm of breathing
b. For expiration
c. Deep inspiration
d. Limit inspiration

95. During exercise when expiration become an active process which centre becomes activate
a. Dorsal Respiratory Group
b. Ventral Respiratory Group
c. Pneumotaxic centre
d. Apneustic centre

96. Complementary breathings are manifestation of
a. Dorsal Respiratory Group
b. Ventral Respiratory Group
c. Pneumotaxic centre
d. Apneustic centre

97. Factors responsible for chemical regulation of respiration
a. PCO_2
b. PO_2
c. H^+ Concentration
d. All of the above

98. Which of the following correct for peripheral chemoreceptors
a. Located in carotid and aortic bodies
b. Sensitive to change in PCO_2, PO_2 and H^+
c. Acute increase in H^+
d. All of the above

99. Which of the following correct for central chemoreceptors
a. Located in carotid and aortic bodies
b. Located in medulla
c. Sensitive to change in H^+ concentration of CSF
d. Both b & c

100. Which of the following is the primary variable for the regulation of central chemoreceptors
a. PCO_2
b. PO_2
c. arterial pH
d. Venous pH

101. Most potent respiratory stimulus is
a. Low plasma pH
b. High plasma pH
c. Low CSF pH
d. High plasma PCO_2

102. Normal respiratory frequency in cattle (breath/min) is
    a. 10-15
    b. 18-22
    c. 21-25
    d. 26-35
103. Normal respiratory frequency in horse (breath/min) is
    a. 10-15
    b. 18-22
    c. 21-25
    d. 26-35
104. Normal respiratory frequency in dog (breath/min) is
    a. 10-14
    b. 15-30
    c. 21-25
    d. 26-35
105. A state in which tissues does not get adequate supply of O_2
    a. Hypoxia
    b. Anoxia
    c. Stagnant hypoxia
    d. Histotoxic hypoxia
106. Cessation of breathing is called as
    a. Hypoxia
    b. Anoxia
    c. Stagnant hypoxia
    d. Histotoxic hypoxia
107. When the arterial blood insufficiently saturated with oxygen because of low PO_2 in the atmosphere being breathed is called as
    a. Stagnant hypoxia
    b. Histotoxic hypoxia
    c. Ambient hypoxia
    d. Anaemic hypoxia
108. When cells are unable to use O_2 that is adequately supplied is known as
    a. Stagnant hypoxia
    b. Histotoxic hypoxia
    c. Ambient hypoxia
    d. Anaemic hypoxia
109. When there is a decrease in oxygen carrying capacity of the blood because of the shortage of Hb termed as
    a. Stagnant hypoxia
    b. Histotoxic hypoxia
    c. Ambient hypoxia
    d. Anaemic hypoxia
110. When oxygen content of blood is normal and tissues receive love oxygen because of general and local circulation failure called as

a. Stagnant hypoxia
b. Histotoxic hypoxia
c. Ambient hypoxia
d. Anaemic hypoxia

111. What type of respiration seem in dog and cat
a. Costal
b. Abdominal
c. Costo-abdominal
d. All of the above

112. What type of respiration seem in ruminants
a. Costal
b. Abdominal
c. Costo-abdominal
d. All of the above

113. What type of respiration seem in horse
a. Costal
b. Abdominal
c. Costo-abdominal
d. All of the above

114. Which of the following is most affected due to shortage of O_2
a. Brain
b. Kidney
c. Liver
d. Intestine

115. Failure of alveoli to open is known as
a. Atelectasis
b. Asphyxia
c. Cyanosis
d. Emphysema

116. Dilation and rapture of alveoli develops
a. Atelectasis
b. Asphyxia
c. Cyanosis
d. Emphysema

117. Entry of air into the pleural cavity is known as
a. Atelectasis
b. Asphyxia
c. Cyanosis
d. Pneumothorax

118. Acute inflammation of lungs called as
a. Atelectasis
b. Asphyxia
c. Pneumonia
d. Pneumothorax

119. Barker syndrome is associated with lack of
    a. Surfactant
    b. Stretch receptor
    c. Neurotransmitter
    d. Plural fluid
120. Barker syndrome is common in
    a. Cattle
    b. Swine
    c. Horse
    d. Both b & c
121. Tracheal cartilages in birds have
    a. Complete rings
    b. Incomplete rings
    c. Both a & b
    d. None of the above
122. In birds gas exchange take place in
    a. Extrapulmonary primary bronchus
    b. Intrapulmonary primary bronchus
    c. Parabronchi
    d. None of the above
123. ……. air sacs present in chicken
    a. 7
    b. 9
    c. 10
    d. 8
124. In birds, inspiration and expiration are
    a. Active
    b. Passive
    c. Inspiration active
    d. Expiration active
125. Penguins and Emu have
    a. Paleopulmonic parabronchi
    b. Neopulmonic parabronchi
    c. Both a & b
    d. None of the above
126. Pigeons, ducks and cranes have
    a. Paleopulmonic parabronchi
    b. Neopulmonic parabronchi
    c. Both a & b
    d. None of the above

Fill in the blank questions

1. The ……...are principal structure of respiratory system.
2. During……..., oxygen is taken in, and carbon dioxide is expelled from the body.
3. Nostrils are more pliable in…….and most rigid in…….
4. Air and food are routed into the proper channels by……
5. **……...**is lid like structure that closes to allow food to pass through the oesophagus.
6. ……...nerve stimulates the diaphragm to contract.
7. Expiratory movements are produced by contraction of the …….and……
8. Inspiratory movements are produced by contraction of the …….and……
9. The primary muscle responsible for inspiration is the……., which contracts to increase thoracic volume.
10. Inflammation of lungs covering causes severe chest pain known as……
11. The most abundant gas in air is……...
12. 2,3 DPG binds to……...chain of Hb.
13. At high altitude, the number of RBC…….in circulation.
14. Hiccups is due to irritation of……nerve.
15. …….is the total volume of gas moved in or out of the airways and alveoli in 1 min.
16. The enzyme……. in the lungs helps break down surfactant, reducing surface tension and preventing alveolar collapse.
17. The _____ is a thin, double-layered sac that surrounds each lung, providing a slippery surface for smooth movement during breathing.
18. The primary respiratory centres in the brainstem receive input from peripheral chemoreceptors, including the _____ bodies.
19. In high-altitude environments, the body may respond to low oxygen levels by increasing the production of _____, promoting red blood cell formation.
20. During _____, oxygen and carbon dioxide are exchanged between maternal and foetal blood in the placenta.
21. The _____ is a protein responsible for carrying oxygen in avian blood, providing an alternative to haemoglobin**.**
22. The _____ reflex is triggered by irritants in the upper respiratory tract, leading to a sudden, forceful expulsion of air.
23. The……...reflex is activated by irritation in the respiratory passages and aims to remove foreign particles.
24. The respiratory system helps regulate the body's acid-base balance by controlling the levels of _____ in the blood.
25. The process of exchanging gases between the atmosphere and the lungs is known as……
26. Carotid body send their signal to respiratory centre via……...nerve
27. Aortic arch sends their signal to respiratory centre via……...nerve
28. **……**act as a pulmonary surfactant.
29. Airflow in neopulmonic parabronchi is**……**

30. In fowl and songbirds, neopulmonic parabronchi is……...developed than paleopulmonic parabronchi.
31. Diaphragm is absent in……
32. Birds have 9 air sacs in which……...air sac is unpaired
33. Site of gas exchange in birds is…….
34. Site of gas exchange in mammals is…….
35. In mammals, alveoli of lungs are lined by surfactant secreting cells known as……while birds have…….

Matching type questions

1. Match the following respiratory quotient values with its feed

Feed	RQ
a. Carbohydrate	1. 0.9
b. Fat	2. 1
c. Protein	3. 0.82-0.85
d. Mixed diet	4. 0.7

2. Match the followings organs with its functions

Organ	Functions
a. Alveoli	1. voice box
b. Larynx	2. Removal of dust from air
c. Ciliated epithelium	3. Transport air to and from lungs
d. Trachea	4. Site of gas exchange

3. Match the following lung capacities and volumes with the quantities

Column I	Column II
a. Residual volume	1. 4500 ml
b. Vital capacity	2. 6000 ml
c. Total lung capacity	3. 3000 ml
d. Inspiratory capacity	4. 1500 ml

4. Match the following columns and select the correct option given below

Column I	Column II
a. Primary site for gas exchange	1. Pons
b. O_2 dissociation curve	2. alveoli
c. Carbonic anhydrase	3. Hb
d. Pneumotaxic centre	4. RBC

5. Match the following columns and select the correct option given below

Column I	Column II
a. Inspiratory capacity	1. ERV+RV
b. Total lung capacity	2. TV+IRV
c. Vital capacity	3. ERV+TV+IRV
d. Functional residual capacity	4. VC+RV

6. Match the following columns and select the correct option given below

Column I	Column II
a. Alveoli	a. Lined with hair
b. Bronchioles	b. Diffusion of gases
c. Nasal chamber	c. Inverted Y- shaped tubes
d. Bronchi	d. small air tubes

7. Match the following disorders with their symptoms

Disorders	Symptoms
a. Asthma	1. Inflammation of nasal tract
b. Bronchitis	2. Blown out alveoli
c. Emphysema	3. Spasm of bronchial muscles
d. Rhinitis	4. Inflammation of bronchi

8. Match the following columns and select the correct option given below

Column I	Column II
a. Haemoglobin	1. Facilitates the transport of carbon dioxide in plasma
b. Carbonic Anhydrase	2. Binds to oxygen and helps in its transport in muscle
c. Myoglobin	3. Converts carbon dioxide into bicarbonate ions in RBC
d. Bicarbonate ion	4. Carries the majority of oxygen in the blood

9. Match the respiratory muscle with its primary function

Column I	Column II
a. Diaphragm	1. Elevates the ribs during inhalation
b. External Intercostals	2. Contracts to decrease thoracic volume during forced exhalation

c. Internal Intercostals	3. Contraction increases thoracic volume during inhalation
d. Sternocleidomastoid	4. Increases the volume of the thoracic cavity during inhalation

10. Match the following columns and select the correct option given below

Column I	Column II
a. Residual Volume	1. Volume of air in the lungs after a maximal inhalation
b. Total Lung Capacity	2. Volume of air that can be forcibly exhaled after a normal tidal volume exhalation
c. Forced Vital Capacity	3. Volume of air remaining in the lungs after a normal tidal volume exhalation
d. Functional Residual Capacity	4. Volume of air in the lungs at the end of a maximal inhalation

11. Match the respiratory parameter with its unit of measurement

Respiratory parameter	unit of measurement
a. Tidal Volume	1. Liters per minute
b. Minute Ventilation	2. Breaths per minute
c. Respiratory Rate	3. Liters
d. Inspiratory Capacity	4. Liters per breath

12. Match the lung structure with its primary function

Lung structure	function
a. Alveolar Capillaries	1. Transport deoxygenated blood to the lungs
b. Type II Pneumocytes	2. Conduct air to alveoli
c. Respiratory Bronchioles	3. Gas exchange site
d. Pulmonary Arteries	4. Secretion of surfactant

13. Match the lung disorder with its characteristic feature

lung disorder	characteristic feature
a. Pulmonary Fibrosis	1. Excessive mucus production and airway obstruction
b. Chronic Obstructive Pulmonary Disease (COPD)	2. Scar tissue formation in the lungs
c. Pulmonary Oedema	3. Infection caused by Mycobacterium tuberculosis
d. Tuberculosis	4. Accumulation of fluid in the alveoli

14. Match the avian respiratory adaptation with its advantage

Respiratory adaptation	**advantage**
a. Unidirectional Airflow	1. Facilitates efficient ventilation during both inhalation and exhalation
b. Lack of Diaphragm	2. Reduces weight for efficient flight
c. Hollow Bones	3. Allows precise control of airflow direction in the respiratory system
d. Air Capillaries	4. Enables continuous gas exchange in the lungs

15. Match the avian respiratory characteristic with its role in thermoregulation

Respiratory characteristic	**Role in thermoregulation**
a. Panting	1. Varied temperatures in different regions of the respiratory system
b. Counter-current Heat Exchange	2. Specialized areas for heat exchange
c. Thermal Windows	3. Minimizes heat loss during cold conditions
d. Regional Heterothermy	4. Facilitates efficient cooling during hot conditions

Answers

Multiple Choice Questions

1	2	3	4	5	6	7	8	9	10
a	b	a	d	c	d	b	a	c	a
11	12	13	14	15	16	17	18	19	20
b	c	d	c	c	a	a	c	d	d
21	22	23	24	25	26	27	28	29	30
d	a	c	a	b	c	b	b	c	b
31	32	33	34	35	36	37	38	39	40
d	a	b	d	a	a	c	d	b	b
41	42	43	44	45	46	47	48	49	50
a	b	c	a	b	b	c	d	d	a
51	52	53	54	55	56	57	58	59	60
c	a	b	c	b	b	d	a	a	d
61	62	63	64	65	66	67	68	69	70
c	c	a	c	c	b	c	b	c	a
71	72	73	74	75	76	77	78	79	80
c	c	b	c	a	c	a	a	b	a
81	82	83	84	85	86	87	88	89	90
a	c	d	a	a	b	a	a	b	b
91	92	93	94	95	96	97	98	99	100
d	d	d	c	b	d	d	d	d	a
101	102	103	104	105	106	107	108	109	110
c	d	a	b	a	b	c	b	d	a
111	112	113	114	115	116	117	118	119	120
a	b	c	a	a	d	d	c	a	d
121	122	123	124	125	126				
a	c	b	a	a	c				

Fill in the blanks

1. Lungs
2. Respiration
3. horse, pig
4. pharynx
5. Epiglottis
6. Phrenic
7. Internal intercostals, abdominal
8. external intercostals, diaphragm
9. diaphragm
10. pleurisy
11. nitrogen
12. Beta
13. Increases

14. Phrenic
15. minute volume
16. Phospholipase
17. Pleura
18. Carotid
19. Erythropoietin
20. foetal respiration
21. Hemocyanin
22. Sneezing
23. Cough
24. carbon dioxide
25. ventilation
26. Glossopharyngeal
27. Vagus
28. Dipalmitoylphosphotidycholine (DPPC)
29. bidirectional
30. more
31. birds
32. clavicular
33. parabronchi/tertiary bronchi
34. alveoli
35. Type-II pneumocyte, granular cells (trilaminar cells)

Matching type questions

1. a-2, b-4, c-1, d-3
2. a-4, b-1, c-2, d-3
3. a-4, b-1, c-2, d-3
4. a-2, b-3, c-4, d-1
5. a-2, b-4, c-3, d-1
6. a-2, b-4, c-1, d-3
7. a-3, b-4, c-2, d-1
8. a-4, b-3, c-2, d-1
9. a-4, b-3, c-2, d-1
10. a-2, b-1, c-4, d-3
11. a-4, b-1, c-2, d-3
12. a-3, b-4, c-2, d-1
13. a-2, b-1, c-4, d-3
14. a-3, b-1, c-2, d-4
15. a-4, b-3, c-2, d-1